Italian Botanist 11: 145–153 (2021)
doi: 10.3897/italianbotanist.11.70173
https://italianbotanist.pensoft.net

RESEARCH ARTICLE

Italian Botanist
Published by Società Botanica Italiana

# Chromosome numbers for the Italian flora: 11

Giovanni Astuti[1], Giulio Barone[2], Emilio Di Gristina[2], Gianniantonio Domina[2], Antonio Giacò[3], Simone Orsenigo[4], Lorenzo Peruzzi[3]

**1** *Orto e Museo Botanico, Sistema Museale di Ateneo, Università di Pisa, Via L. Ghini 13, 56126, Pisa, Italy* **2** *Dipartimento di Scienze Agrarie, Alimentari e Forestali, Università di Palermo, Viale delle Scienze, Edificio 4, I-90128, Palermo, Italy* **3** *Dipartimento di Biologia, Università di Pisa, Via Derna 1, 56126, Pisa, Italy* **4** *Dipartimento di Scienze della Terra e dell'Ambiente, Università di Pavia, Pavia 27100, Italy*

Corresponding author: Giovanni Astuti (giovanni.astuti@unipi.it)

Academic editor: Stefania Biondi | Received 15 June 2021 | Accepted 18 June 2021 | Published 1 July 2021

**Citation:** Astuti G, Barone G, Di Gristina E, Domina G, Giacò A, Orsenigo S, Peruzzi L (2021) Chromosome numbers for the Italian flora: 11. Italian Botanist 11: 145–153. https://doi.org/10.3897/italianbotanist.11.70173

**Abstract**

In this contribution, new chromosome data obtained on material collected in Italy are presented. It includes counts for *Centaurea aegusae*, *Hieracium racemosum* subsp. *lucanum*, *H. australe* subsp. *australe*, *Lysimachia arvensis* subsp. *arvensis*, *Micromeria graeca* subsp. *graeca*, and *M. graeca* subsp. *consentina*.

**Keywords**

cytogeography, cytotaxonomy, endemic taxa, polyploidy

## How to contribute

Texts concerning new chromosome data should be submitted electronically to Giovanni Astuti (giovanni.astuti@unipi.it), including indications on voucher specimens and methods used.

Copyright *Giovanni Astuti et al.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

## Chromosome counts

### *Centaurea aegusae* Domina, Greuter & Raimondo (Asteraceae)

**Chromosome number.** $2n = 18$ (Fig. 1)

**Voucher specimen. ITALY. Sicilia.** Isola di Favignana, Mt. Santa Caterina, Scindo Passo (Favignana, Trapani) (WGS84: 37.920730°N, 12.307299°E), 50 m a.s.l., maritime carbonate cliffs, 25 July 2019, *G. Domina* (PAL).

**Method.** Squash preparations were made on root tips obtained from germinating seeds. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine for 7–8 minutes.

**Observations.** *Centaurea aegusae* is a rosulate chamaephyte endemic to the island of Favignana (Egadi Archipelago, western Sicily). In the past, it has been reported from all the Egadi islands under the name *C. cineraria* L. (Gussone 1843; Lojacono-Pojero 1903). On the basis of a statistical biometric study of the *C. busambarensis* Guss. complex, which represents the *C. cineraria* L. aggregate in Sicily and its offshore islets, *C. aegusae* is now recognized as a distinct species (Domina et al. 2017). The chromosome number $2n = 18$, reported here for the first time, is consistent with previous counts obtained for the other species belonging to the *C. busambarensis* complex (Viegi et al. 1972; Tornadore et al. 1974; Brullo and Pavone 1978; Cela Renzoni and Viegi 1982).

**Figure 1.** *Centaurea aegusae* Domina, Greuter & Raimondo from Isola di Favignana (Favignana, Trapani), $2n = 18$. Scale bar: 10 μm.

## *Hieracium racemosum* subsp. *lucanum* Di Grist., Domina, Gottschl. & Scafidi (Asteraceae)

**Chromosome number.** $2n = 27$ (Fig. 2)

**Voucher specimen. ITALY. Basilicata.** Timpa Rossa (Lauria, Potenza), in clearings of *Quercus cerris* woods (WGS84: 40.107361°N, 15.934836°E), 846 m a.s.l., 18 August 2019, *E. Di Gristina, F. Maturo & F. Scafidi* (PAL n°109701).

**Method.** Squash preparations were made on root tips obtained from germinating seeds. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine for 7–8 minutes.

**Observations.** *Hieracium racemosum* subsp. *lucanum* is a scapose hemicryptophyte, flowering from August to early September. It is currently known only from Timpa Rossa (Lauria, province of Potenza, Basilicata, S Italy) (Di Gristina et al. 2019). The aggregate of *H. racemosum* Willd. is one of the most polymorphic aggregates in the genus *Hieracium* L. s.str. The chromosome number $2n = 3x = 27$, reported here for the first time on material from the *locus classicus* of this subspecies, is included in the variability ($2n = 27$, $2n = 36$) reported for the *H. racemosum* aggregate by Sell and West (1976), Brullo et al. (2005), Di Gristina et al. (2006) and Geraci et al. (2007).

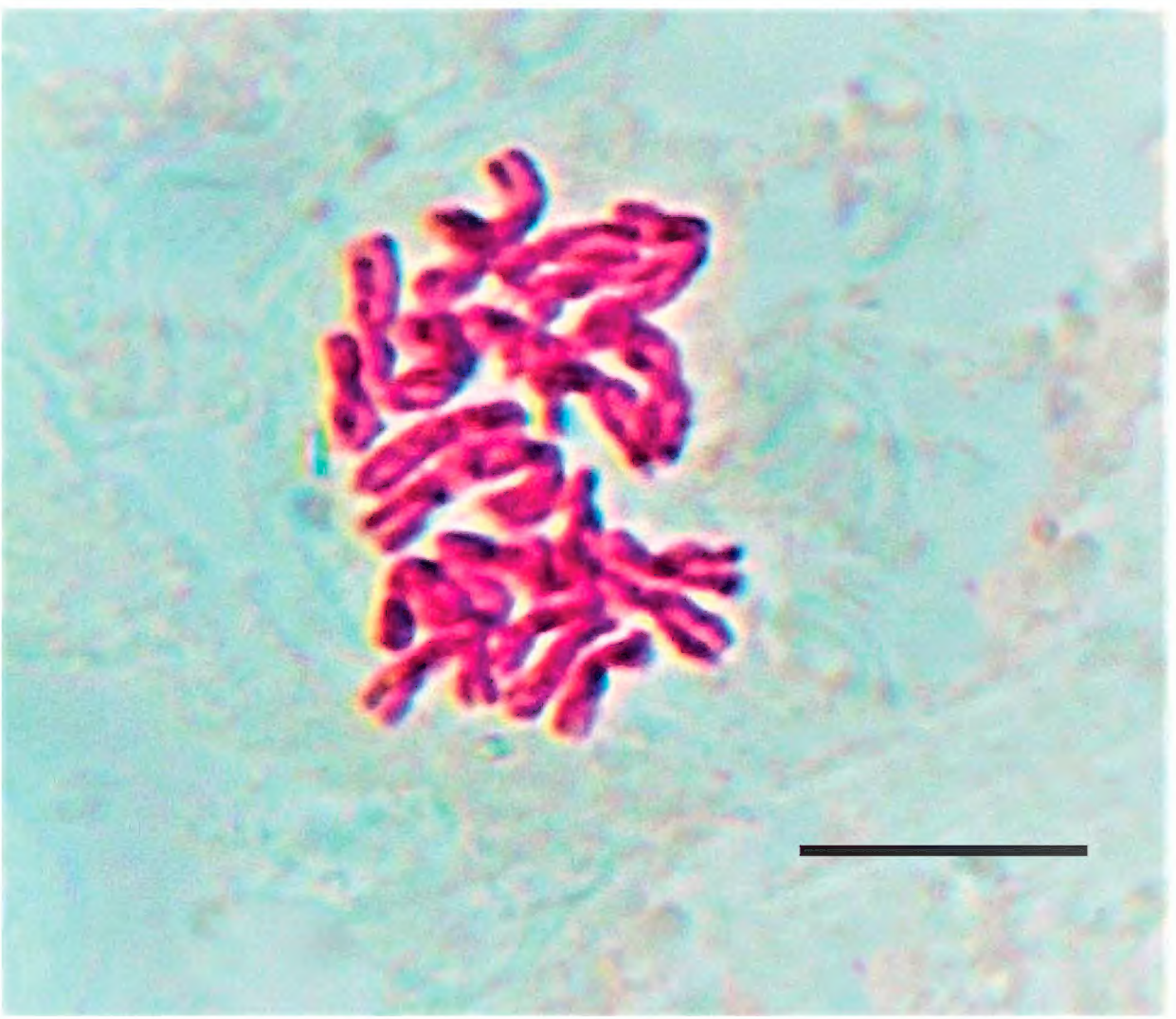

**Figure 2.** *Hieracium racemosum* subsp. *lucanum* Di Grist., Domina, Gottschl. & Scafidi from Timpa Rossa (Lauria, Potenza) $2n = 27$. Scale bar: 10 μm.

## *Lysimachia arvensis* (L.) U.Manns & Anderb. subsp. *arvensis* (Primulaceae)

**Chromosome number.** $2n = 40$ (Fig. 3)

**Voucher specimen. ITALY. Sicilia.** Fossa della Garofala (Palermo) (WGS84: 38.107529°N, 13.350157°E), 30 m a.s.l., irrigated *Citrus* grove, 28 May 2021, *G. Barone* (SAF).

**Method.** Squash preparations were made on root tips obtained from germinating seeds. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine for 7–8 minutes.

**Observations.** *Lysimachia arvensis* subsp. *arvensis* is an annual plant native to the Mediterranean Basin, but widely distributed around the world (Jiménez-López et al. 2019). It displays a petal colour polymorphism. Indeed, blue- and orange-flowered plants occur in monomorphic and polymorphic populations across its native range in Europe (Sánchez-Cabrera et al. 2021). The chromosome number $2n = 40$, found here in material with orange flowers, agrees with previous reports from Italy and abroad (Löve and Löve 1982; Moneim et al. 2003).

E. Di Gristina, G. Domina, G. Barone

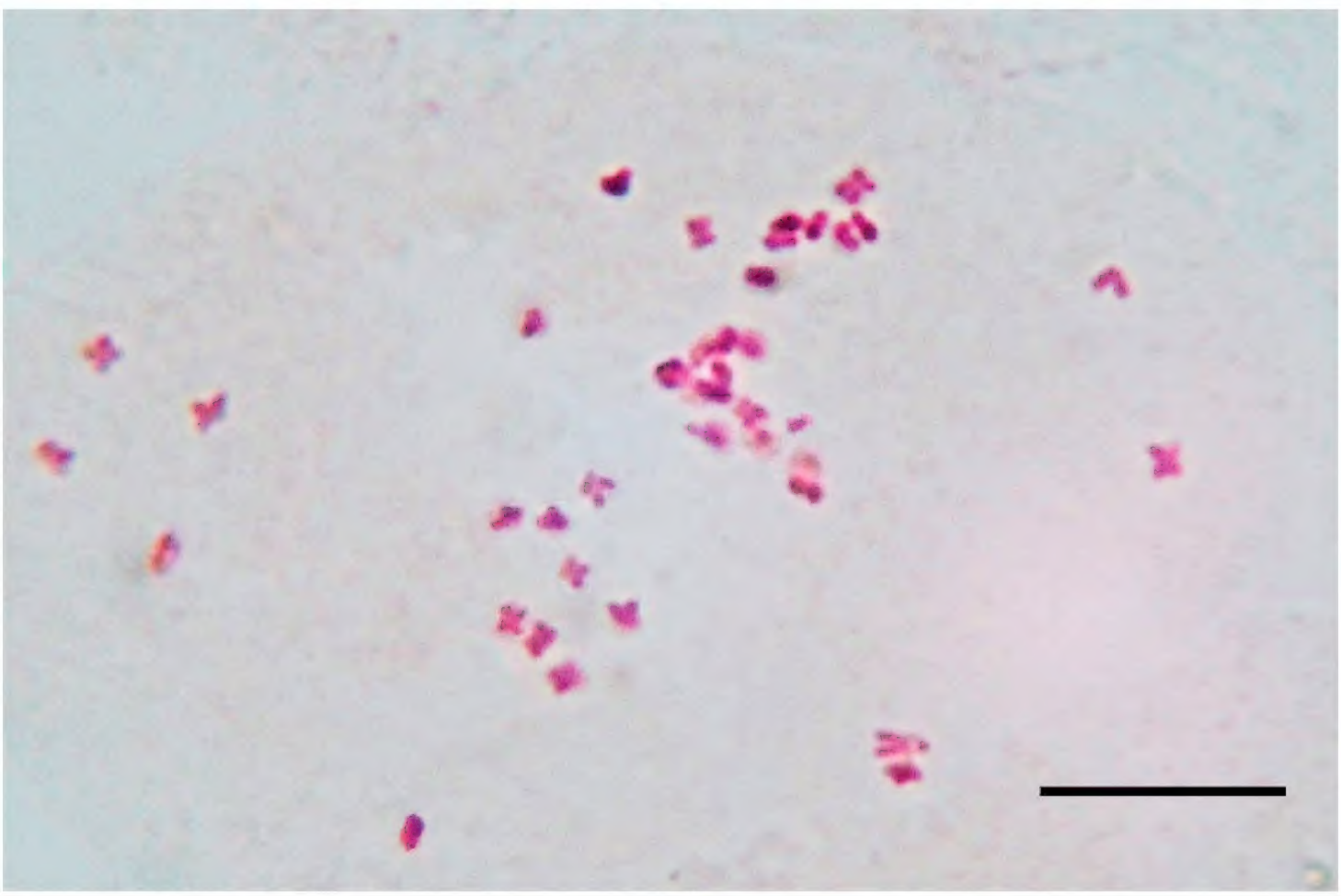

**Figure 3.** *Lysimachia arvensis* (L.) U.Manns & Anderb. subsp. *arvensis* from Fossa Garofala (Palermo), $2n = 40$. Scale bar: 10 μm.

### *Micromeria graeca* (L.) Benth. ex Rchb. subsp. *consentina* (Ten.) Guinea

**Chromosome number.** $2n = 30$ (Fig. 4)

**Voucher specimen. ITALY. Calabria.** Scalo Ferroviario di San Marco Argentano (Cosenza), nei pressi dello svincolo autostradale (WGS84: 39.62092°N, 16.22147°E), gariga a margine strada, 120 m s.l.m., 17 August 2018, *L. Peruzzi* (FI).

**Method.** Squash preparations were made on root tips obtained from seeds germinating on 1% agar in Petri dishes. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine.

**Observations.** This taxon is endemic to Italy, where it occurs in Calabria and Sicily, doubtful in Abruzzo and Basilicata, and no longer found in Campania and Puglia (Bartolucci et al. 2018). We here report the first chromosome count for this subspecies, $2n = 30$, which attests for a diploid status in contrast with the allegedly polyploid chromosome number $2n = 60$ reported for the typical *Micromeria graeca* subsp. *graeca* (Morales Valverde 1990; Luque and Dìaz Lifante 1991; see also below). This further attests for an independence at species level for this taxon, as already argued by Peruzzi in Roma-Marzio et al. (2018).

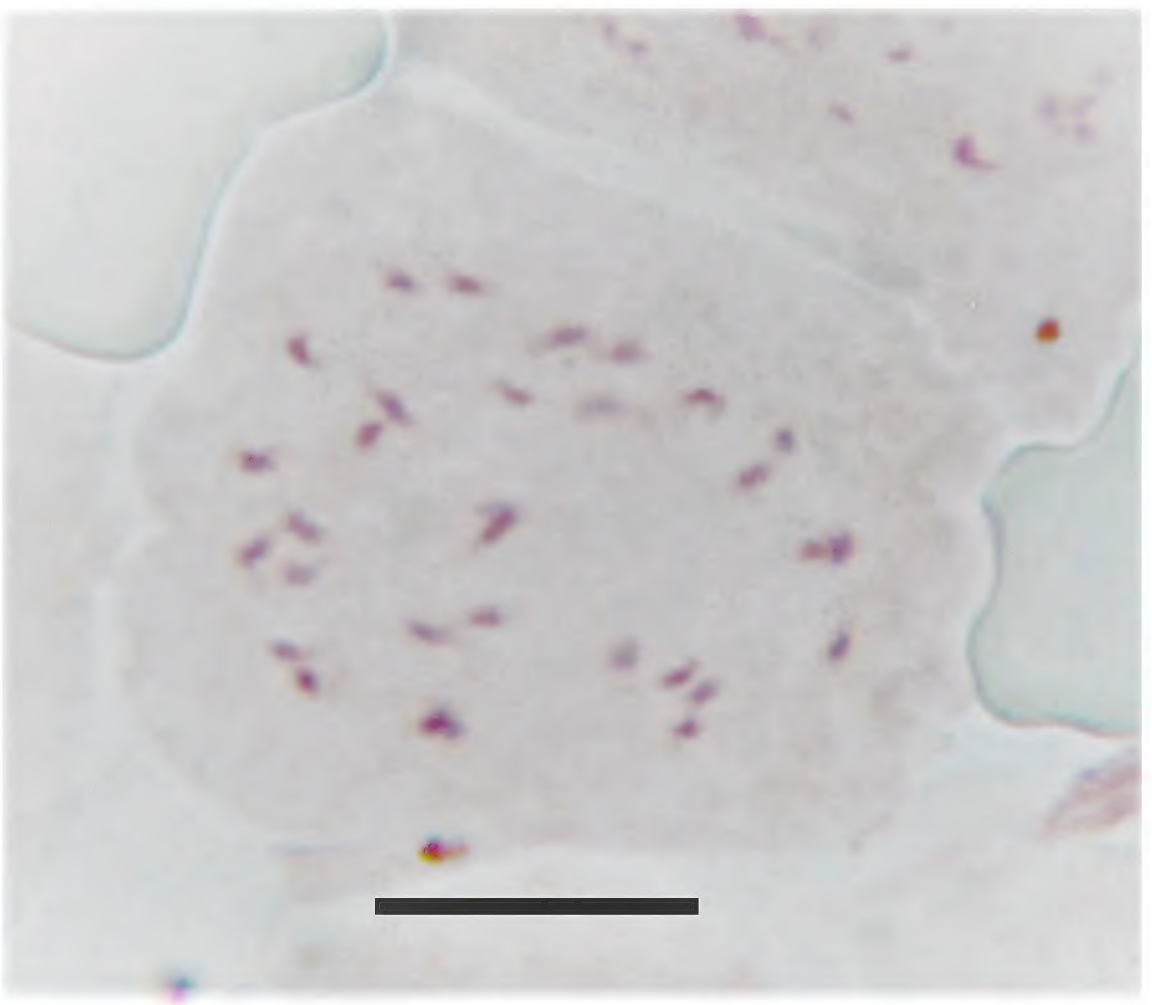

**Figure 4.** *Micromeria graeca* (L.) Benth. ex Rchb. subsp. *consentina* (Ten.) Guinea from San Marco Argentano (Cosenza), Scalo Ferroviario, $2n = 30$. Scale bar: 10 μm.

## *Micromeria graeca* (L.) Benth. ex Rchb. subsp. *graeca*

**Chromosome number.** $2n = 60$ (Fig. 5)

**Voucher specimen. ITALY. Calabria.** Scalo Ferroviario di San Marco Argentano (Cosenza), nei pressi dello svincolo autostradale (WGS84: 39.62064°N, 16.22079°E), nelle fessure dell'asfalto a margine strada, 118 m s.l.m., 17 August 2018, *L. Peruzzi* (seeds collected and deposited at the germplasm bank of the Department of Biology, University of Pisa).

**Method.** Squash preparations were made on root tips obtained from seeds germinating on 1% agar in Petri dishes. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine.

**Observations.** This taxon is distributed throughout the Mediterranean region from Morocco to the Near East (Govaerts 2021). This is the first count of this subspecies for Italian populations, whereas other counts have been published for the Iberian Peninsula, where two different chromosome numbers have been reported so far, $2n = 20$ (Bjorkqvist et al. 1969) and $2n = 60$ (Morales Valverde 1990; Luque and Dìaz Lifante 1991). Our count confirms the latter number, which seems the commonest for the species. Concerning the genus *Micromeria* Benth., it seems that most counts showing $x = 10$, 11, and 25 have to be referred to species now belonging to *Clinopodium* L. (Rice 2014+), raising some doubts on the reliability of the count published by Bjorkvist et al. (1969). Assuming $x = 15$, the autonymic subspecies represents a tetraploid unit. It is of particular interest that the population studied here grows a few dozen metres away from the studied population of *M. graeca* subsp. *consentina* (Roma-Marzio et al. 2018).

A. Giacò, G. Astuti, L. Peruzzi

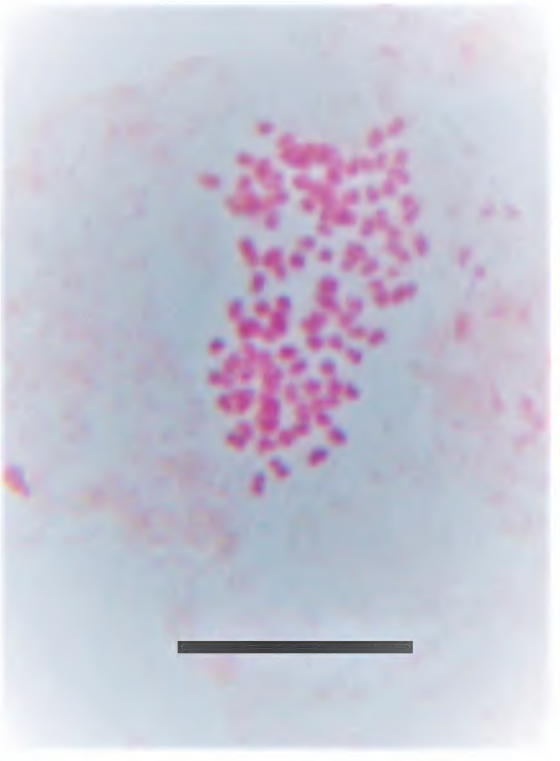

**Figure 5.** *Micromeria graeca* (L.) Benth. ex Rchb. subsp. *graeca* from San Marco Argentano (Cosenza), Scalo Ferroviario, $2n = 60$. Scale bar: 10 μm.

## *Hieracium australe* Fr. subsp. *australe* (Asteraceae)

**Chromosome number.** $2n = 27$ (Fig. 6)

**Voucher specimen. ITALY. Lombardia.** Milano (WGS84 45.47032°N, 9.17739°E), mura del Castello Sforzesco, 125 m, 2014, *S. Orsenigo* (Kew Gardens Millennium Seed Bank, Serial No. 808376).

**Method.** Squash preparations were made on root tips obtained from germinating seeds. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine for 7–8 minutes.

**Observations.** *Hieracium australe* is a perennial species distributed in France, Italy, Hungary, and Romania (Greuter and Raab-Straube 2008). *Hieracium australe* subsp. *australe* is narrow endemic to Milan, where it grows on the ancient walls of the city and, in particular, on the walls of the Sforza castle (Orsenigo et al. 2019). The chromosome number $2n = 3x = 27$, reported here for the first time, is consistent with observations made on other species belonging to *H.* sect. *Italica* (Fr.) Arv-Touv., such as those of the *H. racemosum* aggregate (Brullo et al. 2005; Raimondo and Di Gristina 2004; Di Gristina et al. 2006), and to an apomictic (agamospermy) way of reproduction typical of the genus (Mráz and Zdvořák 2019).

G. Astuti, A. Giacò, S. Orsenigo

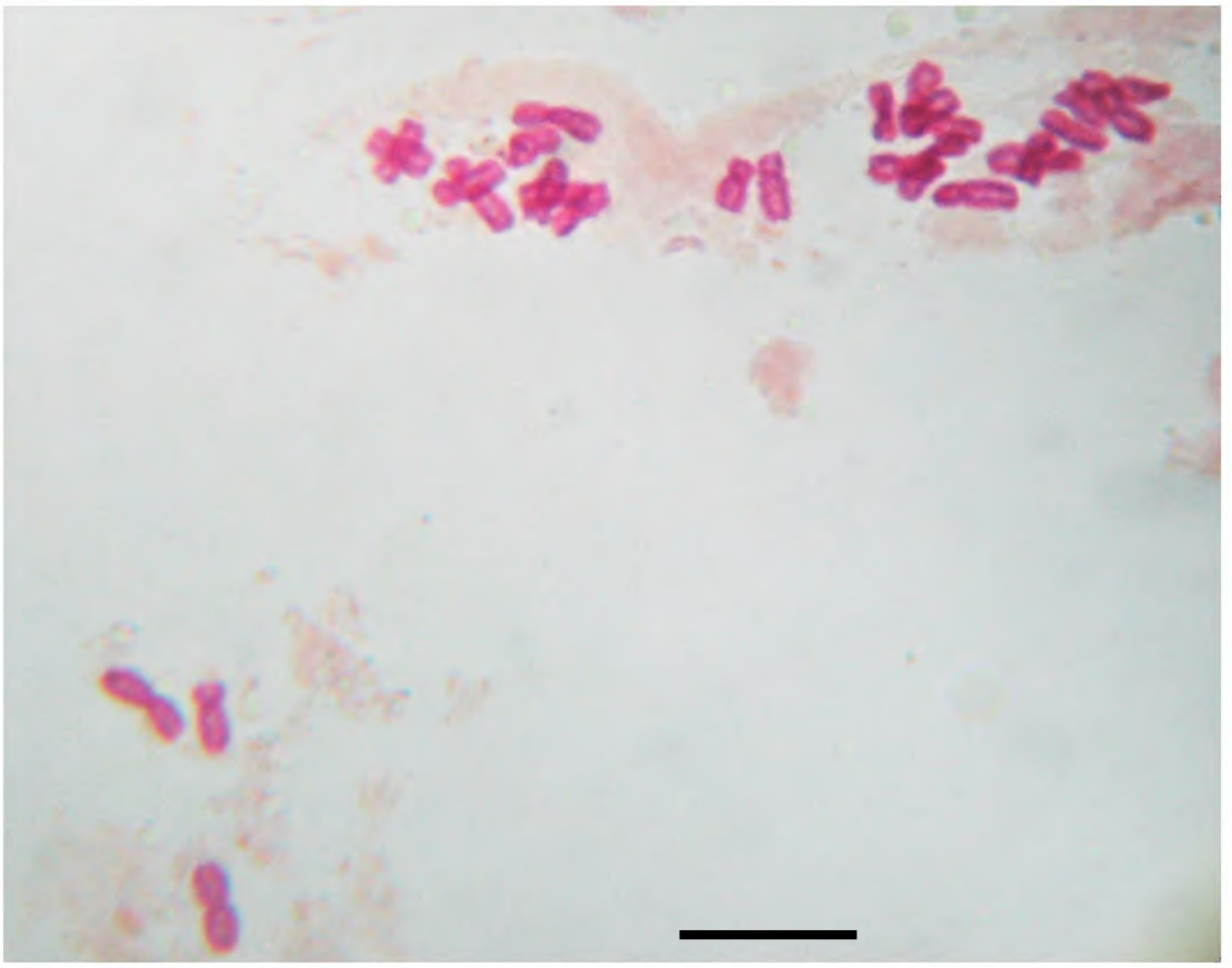

**Figure 6.** *Hieracium australe* Fr. subsp. *australe* from Sforza Castle (Milano), $2n = 27$. Scale bar: 10 μm.

## References

Bartolucci F, Peruzzi L, Galasso G, Albano A, Alessandrini A, Ardenghi NMG, Astuti G, Bacchetta G, Ballelli S, Banfi E, Barberis G, Bernardo L, Bouvet D, Bovio M, Cecchi L, Di Pietro R, Domina G, Fascetti S, Fenu G, Festi F, Foggi B, Gallo L, Gottschlich G, Gubellini L, Iamonico D, Iberite M, Jiménez-Mejías P, Lattanzi E, Marchetti D, Martinetto E, Masin RR, Medagli P, Passalacqua NG, Peccenini S, Pennesi R, Pierini B, Poldini L, Prosser F, Raimondo FM, Roma-Marzio F, Rosati L, Santangelo A, Scoppola A, Scortegagna S, Selvaggi A, Selvi F, Soldano A, Stinca A, Wagensommer RP, Wilhalm T, Conti F (2018) An updated checklist of the vascular flora native to Italy. Plant Biosystems 152(2): 179–303. https://doi.org/10.1080/11263504.2017.1419996

Björnqvist I, von Bothmer R, Nilsson Ö, Nordenstam B (1969) Chromosome numbers in Iberian angiosperms. Botaniska Notiser 122: 271–283.

Brullo S, Campo G, Romano S (2005) Indagini citotassonomiche sul genere *Hieracium* L. (Asteraceae) in Sicilia. Informatore Botanico Italiano 36(2): 481–485.

Brullo S, Pavone P (1978) Numeri cromosomici per la flora italiana: 464–483. Informatore Botanico Italiano 10(2): 248–264.

Cela Renzoni G, Viegi L (1982) *Centaurea cineraria* s.l. (Asteraceae) in Italia. Revisione tassonomica. Atti della Società Toscana Scienze Naturali Pisa. Memorie, serie B 89: 99–144.

Di Gristina E, Geraci A, Raimondo FM (2006) Biosystematic investigation on *Hieracium symphytifolium* (Asteraceae). Bocconea 19: 275–286.

Di Gristina E, Domina G, Gottschlich G, Maturo F, Scafidi F (2019) *Hieracium racemosum* subsp. *lucanum* (Asteraceae), a new hawkweed from southern Italy. Phytotaxa 425(5): 297–300. https://doi.org/10.11646/phytotaxa.425.5.5

Domina G, Greuter W, Raimondo FM (2017) A taxonomic reassessment of the *Centaurea busambarensis* complex (Compositae, Cardueae), with description of a new species from the Egadi Islands (W Sicily). Israel Journal of Plant Sciences 64(1–2): e51.

Geraci A, Di Gristina E, Schicchi R (2007) Report (1641). In: Kamari G, Blanché C, Garbari F (Eds) Mediterranean chromosome number reports – 17. Flora Mediterranea 17: 315.

Govaerts R (2021) World Checklist of Lamiaceae. Facilitated by the Royal Botanic Gardens, Kew. http://wcsp.science.kew.org/ [Retrieved 14 June 2021]

Greuter W, Raab-Straube E (2008) Med-Checklist 2. OPTIMA Secretariat, Palermo, 798 pp. https://doi.org/10.3372/wi.38.38207

Jiménez-López FJ, Arista M, Talavera M, Pannell JR, Ortiz PL (2019) Heritabilities of lateral and vertical herkogamy in *Lysimachia arvensis*. Plant Species Biology 34: 31–37. https://doi.org/10.1111/1442-1984.12229

Löve A, Löve A (1982) IOPB chromosome number reports LXXVI. Taxon 31(3): 583–587. https://doi.org/10.1002/j.1996-8175.1982.tb03560.x

Luque T, Dìaz Lifante Z (1991) Chromosome numbers of plants collected during Iter Mediterraneum I in the SE of Spain. Bocconea 1: 303–364.

Moneim A, Aboel Atta II, Shehata AA (2003) On the delimitation of *Anagallis arvensis* L. (Primulaceae) 1. Evidence based on macromorphological characters, palynological features

and karyological studies. Pakistan Journal of Biological Sciences 6: 29–35. https://doi.org/10.3923/pjbs.2003.29.35

Morales Valverde R (1990) Números cromosomáticos de plantas occidentales, 582–590. Analés del Jardin Botánico de Madrid 47(1): 193–198.

Mráz P, Zdvořák P (2019) Reproductive pathways in *Hieracium* s.s. (Asteraceae): strict sexuality in diploids and apomixis in polyploids. Annals of Botany 123: 391–403. https://doi.org/10.1093/aob/mcy137

Orsenigo S, Gottschlich G, Galasso G (2019) The typification and identity of *Hieracium australe* Fr. (Asteraceae). Phytotaxa 388: 207–211. https://doi.org/10.11646/phytotaxa.388.2.8

Raimondo FM, Di Gristina E (2004) *Hieracium pignattianum* (Asteraceae), a new species from Madonie Mountains (N-Sicily). Bocconea 17: 313–324.

Rice A, Glick L, Abadi S, Einhorn M, Kopelman NM, Salman-Minkov A, Mayzel J, Chay O, Mayrose I (2014+) The Chromosome Counts Database (CCDB) a community resource of plant chromosome numbers. https://doi.org/10.1111/nph.13191 [accessed 14 June 2021]

Roma-Marzio F, Lastrucci L, Guzzon F, Ardenghi NMG, Peruzzi L, Mossini S (2018) Nuove segnalazioni floristiche italiane 5. Flora vascolare (28–46). Notiziario della Società Botanica Italiana 2(2): 205–210.

Sánchez-Cabrera M, Jiménez-López FJ, Narbona E, Arista M, Ortiz PL, Romero-Campero FJ, Ramanauskas K, Igić B, Fuller AA, Whittall JB (2021) Changes at a critical branchpoint in the anthocyanin biosynthetic pathway underlie the blue to orange flower color transition in *Lysimachia arvensis*. Frontiers in Plant Science. https://doi.org/10.3389/fpls.2021.633979

Sell PD, West C (1976) *Hieracium* L. In: Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH, Walters SM, Webb DA (Eds) Flora Europaea (Vol. 4). Cambridge University Press, Cambridge, 358–410.

Tornadore N, Popova M, Garbari F (1974) Numeri cromosomici per la flora italiana:172–181. Informatore Botanico Italiano 6(1): 43–54.

Viegi L, Cela Renzoni G, Corsi G, Garbari F (1972) Numeri cromosomici per la flora italiana: 135–144. Informatore Botanico Italiano 4(3): 229–236.